

LCA studies of biofuels in multi-output biorefineries

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The holistic nature of Life Cycle Assessment (LCA) is becoming an indispensable feature in the assessment of sustainable development of society. It is therefore integrated more and more in decision making, where especially the Carbon Footprint is the exponent of the increasing popularity of LCA. However, several methodological choices still cause discrepancies in the final results, where the allocation procedure is a key issue. Much can be learnt from the current situation, where different regions propose new Carbon Footprint methodologies, with their own specific methodological choices. This causes problems when incorporating LCA results, such as the greenhouse gas (GHG) savings of biofuels, in legislation. In this work, a case study is executed in a Belgian multi-output biorefinery producing a mix of food, feed and fuel. Results, calculated with a black box and subprocess approach for economical value, mass, energy and exergy allocation, show discrepancies of up to 59% between the same procedure in subprocess and black box allocation, with a factor 4.1 difference within black box allocation approaches and 1.8 within subprocess allocation. The GHG savings of the biofuel versus the fossil fuel equivalent differ from 21 to 56%. When considering a broad waste definition, as is suggested by some methodologies, GHG savings range up to 80%. This work highlights that the subprocess approach is preferred, as this reflects reality better. Furthermore, physical relationships, and especially exergy, are very useful in allocation, as economical values fluctuate in time, and can cause difficulties in finding representative values of intermediate flows in biorefineries.